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SOLIDS FLOW COLLECTOR

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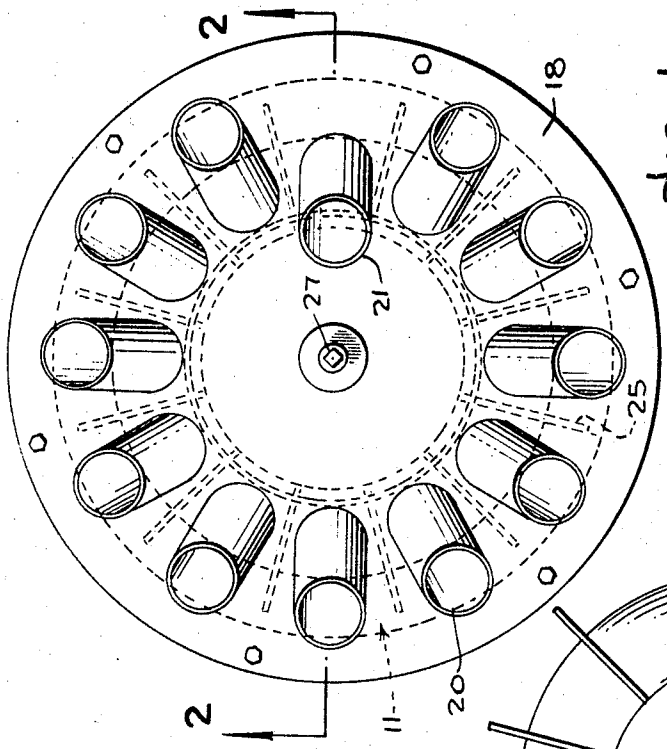


FIG. 1

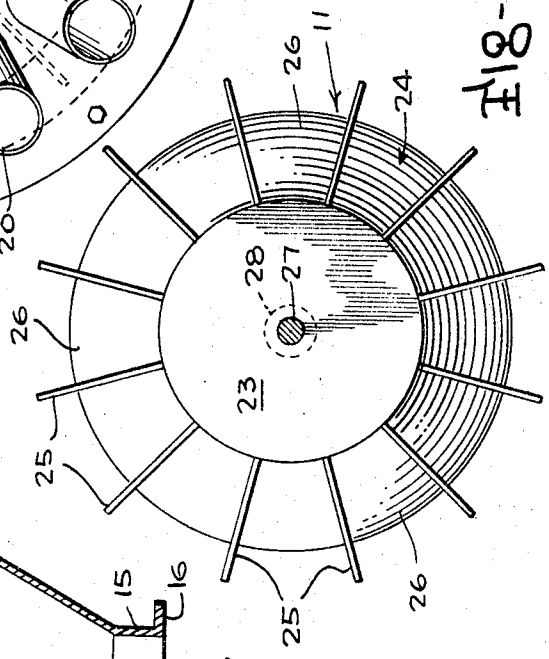


FIG. 3

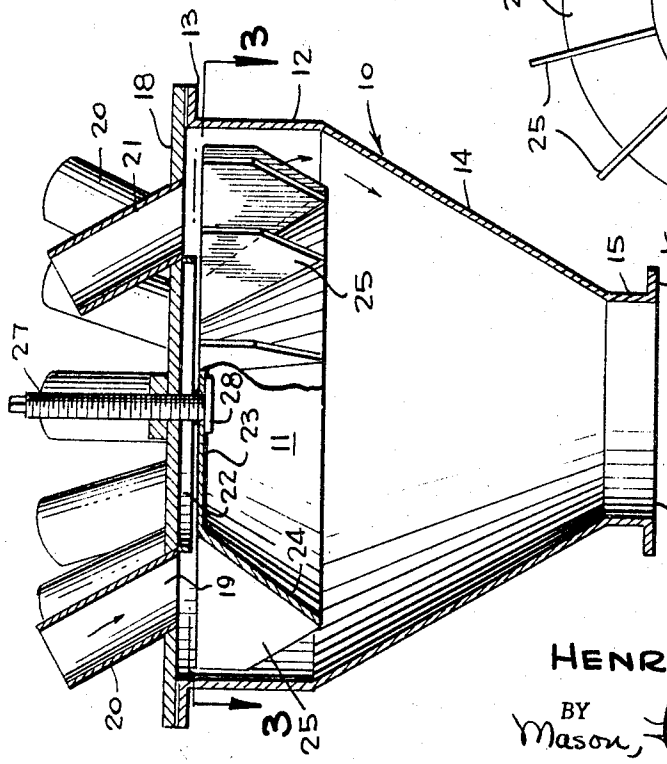


FIG. 2

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SOLIDS FLOW COLLECTOR

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ABSTRACT OF THE DISCLOSURE

A solids flow collector for combining a plurality of streams of particulate solids withdrawn from an elevated mass of solids including a housing member having a plurality of inlet ports communicable with passage means for the streams of particulate solids and an outlet port, a flow restrictor disposed in the housing member between the inlet ports and the outlet port, the flow restrictor having a configuration suitable for intercepting solids introduced into the housing member and the housing member having a flange disposed adjacent the inlet ports for preventing cross flow of solids between the inlet ports.

This invention relates to blending particulate solids, and more particularly to an apparatus for combining and equalizing a plurality of streams of particulate solids in gravimetric flow.

In the prior art, there has been developed a method of blending particulate solids generally consisting of withdrawing the particulate solids in gravimetric flow from a plurality of geometrically diverse points in an elevated container holding a mass of the solids to be blended, and then recombining the solids. In such method, the various streams of solids withdrawn from the elevated mass of solids are recombined so that the solids are reunited in a common bulk which either may be recycled for additional blending, or drawn off as a finished product. There further have been developed in the prior art, various types of collector devices for recombining the streams of solids which generally include a housing having the plurality of inlets communicating with a plurality of conduits for conveying the streams of solids, and a single outlet through which the recombined solids are discharged. In many such devices, there also is utilized a flow restrictor disposed within the housing which functions to equalize the flow of solids from the plurality of conduits.

In the operation of gravimetric type blenders utilizing a collector device either with or without a flow restrictor, it has been found that relatively large or heavyweight solids readily can be processed to provide a highly uniform blend. However, it further has been experienced in the blending of relatively small or lightweight solids that direct flow of the streams of solids from the plurality of feed conduits through the collector devices does not always occur, which results in nonuniform blending of the solids. Often, it has been found in blending small or lightweight solids that undesirable cross flow of solids will occur in the collector device, causing reverse flow in one or more of the feeder conduits. This operating condition is highly undesirable, in that the withdrawal of solids from the geometrically diverse locations in the elevated mass of solids at equal rates is disturbed, thereby appreciably affecting the quality of blending occurring upon the recombination of the streams of solids in the collector device. It, therefore, has been found desirable to provide a collector device which will prevent the cross flow of streams of particulate solids in the collector device.

Accordingly, it is the principal object of the present invention to provide an improved collector device for recombining a plurality of streams of particulate solids.

Another object of this invention is to provide an improved collector device for recombining a plurality of streams of particulate solids which will permit the withdrawal of particulate solids from various geometrically diverse locations in an elevated mass of particulate solids at equal flow rates.

A further object of the present invention is to provide an improved collector device for recombining a plurality of streams of particulate solids which will prevent the reverse flow of particulate solids in a plurality of conduits introducing the particulate solids into the collector device.

A still further object of the present invention is to provide an improved collector device for recombining a plurality of streams of particulate solids wherein cross flow of streams of particulate solids within the collector means is prevented.

Another object of the invention is to provide an improved collector device for recombining a plurality of streams of particulate solids in which peripheral flow of streams of particulate solids is prevented.

A further object of the present invention is to provide a novel collector device for recombining a plurality of streams of particulate solids wherein a plurality of streams of particulate solids introduced into the collector device are guided directly to the discharge end of the collector means.

A still further object of the present invention is to provide a novel collector member for recombining a plurality of streams of particulate solids adapted to operate to produce uniform blending of the solids, which is simple in design, easy to construct and inexpensive to operate and maintain.

Other objects and advantages of the present invention will be more clearly understood to those persons having skill in the art to which the present invention relates, from the following description taken in conjunction with the accompanying drawing, wherein:

FIGURE 1 is a top plan view of an embodiment of the invention;

FIGURE 2 is a cross-sectional view taken along line 2—2 in FIGURE 1; and

FIGURE 3 is a cross-sectional view taken along line 3—3 in FIGURE 2.

In accordance with the broad aspects of the present invention, there is provided a solids flow collector suitable for recombining a plurality of streams of particulate solids withdrawn from an elevated mass of solids generally comprising a housing member having a plurality of inlet ports communicable with passage means for the streams of particulate solids and an outlet port, a flow restrictor disposed in the housing member between the inlet ports and the outlet port, the flow restrictor having a configuration suitable for intercepting solids introduced through the inlet ports into the housing member and the housing member having a flange disposed adjacent the inlet ports for preventing cross flow of solids between the inlet ports.

Referring to the drawing, there is illustrated an embodiment of the invention. Generally, the embodiment includes a housing member **10** and a flow restrictor **11** disposed within the housing member. The housing member **10** includes an upper vertical cylindrical section **12** having an upper peripheral flange **13**, an intermediate inverted frustoconically shaped section **14** and a lower vertical cylindrical section **15** having a lower peripheral flange **16**. The lower vertical cylindrical section **15** has a diameter smaller than the diameter of the upper vertical cylindrical section **12** and provides a lower discharge opening **17** for the housing member. The upper end of the housing member is closed by a circular top wall **18** which is seated on the peripheral flange **13** and is rigidly

secured thereto by suitable fastening means. The angle of inclination of the inverted frustoconically shaped section **14** is at least equal to and preferably in excess of the angle of repose of the particulate solids processed through the collector device. In addition, the height of the cylindrical section **12** is slightly greater than the height of the flow restrictor **11**.

The circular top wall **18** is provided with a plurality of inlet ports **19** which communicate with a plurality of conduits or downcomers **20**. The conduits **20** are provided with inlets located at geometrically diverse locations in an elevated storage bin containing a mass of particulate solids to be blended. The inlet ports **19** are circumferentially spaced relative to and equidistant from the vertical axis of the housing member. Each of the inlet ports **19** has the same cross-sectional area. In addition, each of the conduits or downcomers **20**, with the exception of the conduit **21** which is adapted to be connected to the bottom axial opening of the elevated storage bin, is inclined inwardly and downwardly at the same angle, so that particulate solids introduced into the collector device will impinge on the side wall of the flow restrictor. The angle of inclination of the conduits **20** is at least equal and preferably in excess of the angle of repose of the particulate solids processed through the collector device.

The inlet ports **19** in the top wall **18** are arranged on a circular centerline disposed concentric with the side wall sections of the housing member. Depending from the top wall **18** is an annular flange **22** disposed above the flow restrictor **11** and concentric with the circular centerline of the inlet ports **19**. As best illustrated in FIGURE 2, the annular flange **22** has a diameter equal to or slightly less than the diameter of a circle including the inner portions of the inlet ports **19**. As will be described in detail later, the annular flange **22** functions to direct streams of particulate solids conveyed down through the conduits or downcomers **20** and the inlet ports **19** toward the flow restrictor **11**.

The flow restrictor **11** has a frustoconically shaped configuration, including a horizontal upper wall **23** and an inclined side wall **24**. The horizontal upper wall **23** is substantially circular and has a diameter slightly less than the diameter of the annular flange **22**. The diameter of the lower edge of the inclined wall **24** has a diameter slightly greater than the diameter of a circle including the outer portions of the inlet ports **19**, so that upon vertical adjustment of the flow restrictor within a limited range, particulate solids introduced into the housing member through conduits **20** and inlet ports **19** will impinge on side wall **24**. In addition, the angle of inclination of the side wall **24** of the flow restrictor is at least equal and preferably exceeds the angle of repose of the particulate solids processed through the collector device. The side wall **24** also is provided with a plurality of radially projecting fins **25** which are circumferentially spaced, as best illustrated in FIGURE 3, to provide a plurality of passageways **26** therebetween. Preferably, the passageways **26** are vertically aligned with the inlet ports **19** so that streams of particulate solids introduced into the housing member through conduits **20** and inlet ports **19** will impinge on the side wall **24** of the flow restrictor and be guided downwardly between successive fins **25** through passageways **26**.

The flow restrictor **11** is vertically adjustable by means of an axially disposed threaded member **27** threaded through a suitable opening in top wall **18** of the housing member. The lower end of the threaded member **27** extends through an axial opening in the upper wall **23** of the flow restrictor and is provided with an element **28** forming an annular shoulder on which the upper wall **23** of the flow restrictor is seated. The diameter of the lower end of the flow restrictor is smaller than the diameter of the cylindrical section **12** of the housing member so that when the flow restrictor is adjusted vertically within a limited range, the annular horizontal area between the lower edge of the flow restrictor and the side wall of the housing member can be varied to provide a throttling or valving action on the particulate solids flowing through the annular interspace between the lower peripheral edge of the flow restrictor and the side walls of the housing member.

In the operation of the embodiment of the invention illustrated in the drawing, particulate solids withdrawn from the elevated storage bin flow through the conduits **20** and are introduced into the housing member through inlet ports **19**. As the streams of particulate solids are introduced into the housing member through the inlet ports **19**, the annular flange **22** depending from the top wall **18** of the housing member directs the streams of solids downwardly and towards the inclined wall **24** of the restrictor and prevents the streams of solids from flushing or flowing diametrically relative to the vertical centerline of the device, thereby possibly entering another inlet port and causing reverse flow in the communicating conduit. The streams of solids introduced into the housing member through the inlet ports **19** and directed downwardly impinge on the inclined wall **24** and are directed downwardly and outwardly toward the side walls of the housing member, whereupon, they pass through the interspace between the lower peripheral edge of the flow restrictor and the side wall of the housing member, and flow downwardly to the lower end of the housing member where they are discharged through discharge opening **17**. As the streams of particulate solids traverse the upper region of the housing member, the streams flow through passageways **26** and are prevented from flowing peripherally about inclined wall **24** of the flow restrictor by the radial fins **25**. The elimination of any such peripheral flow of the streams of particulate solids prevents a stream of solids entering through any one inlet port **19** from flowing toward and into any adjacent inlet port thereby causing reverse flow in a communicating conduit **20**. The streams of particulate solids in the upper region of the housing member are thus caused to flow at equal rates through the interspace between the flow restrictor and the side wall of the housing member, and downwardly through the lower region of the housing member where they are recombined and discharged through outlet port **17**. The particulate solids discharged through the outlet port **17** either can be recycled to the elevated storage bin for another blending pass to produce more intimate blending, or can be drawn off as a finished product.

The flow restrictor **12** can be adjusted vertically to control the flow rate of the solids passing through the interspace between the flow restrictor and the side wall of the housing member, and adjusted according to the nature of the particulate solids being processed to prevent bridging of the material between the flow restrictor and the conical section **14** of the housing member.

The combination of the flow restrictor and the annular flange **22** causes the various streams of particulate solids introduced into the housing member through inlet ports **19** to flow at equal rates. As previously mentioned, the radial fins **25** further assist in preventing blocking or reverse flow in any of the conduits. With equalized flow rates in each of the inlet ports **19**, the solids traversing the upper region of the housing member attain a state of equilibrium. After the material in the upper region passes through the interspace between the flow restrictor and the side wall of the housing member, the solids are recombined in the lower region of the housing member and are discharged through the discharge port **17**.

From the foregoing detailed description it will be evident that there are a number of changes, adaptations and modifications of the present invention which come within the province of those skilled in the art. However, it is intended that all such variations not departing from the spirit of the invention be considered as within the scope thereof as limited solely by the appended claims.

I claim:

1. A solids flow collector suitable for combining a plurality of streams of particulate solids withdrawn from an elevated mass of solids comprising a housing member having a plurality of inlet ports communicable with passage means for said streams of particulate solids and an outlet port, a flow restrictor disposed in said housing member between said inlet ports and said outlet port, said flow restrictor having a configuration suitable for intercepting solids introduced through said inlet ports into said housing member and said housing member having a flange disposed adjacent said inlet ports for preventing cross flow of solids between said inlet ports.

2. A solids flow collector according to claim 1, wherein said inlet ports are disposed at the same level and are spaced circumferentially relative to and equidistantly from the vertical centerline of the housing member.

3. A solids flow collector according to claim 1, wherein the combined cross-sectional areas of the inlet ports are greater than the cross-sectional area of the outlet port.

4. A solids flow collector according to claim 1, wherein said flow restrictor is provided with a plurality of outwardly projecting fins.

5. A solids flow collector according to claim 4, wherein said fins are peripherally spaced providing a plurality of passage means for guiding solids entering into said housing member substantially toward said outlet port.

6. A solids flow collector according to claim 1, wherein said flow restrictor is adjustable along the vertical centerline of the housing member and said housing member includes a section of diminishing cross-sectional area extending toward said outlet port along said vertical centerline, cooperable with said flow restrictor to valve the flow of material flowing through the interspace between said flow restrictor and said section of the housing member.

7. A solids flow collector according to claim 1, wherein said housing member includes a top wall, said inlet ports are provided in said top wall and said flow restrictor is provided with a frustoconically configured wall for intercepting solids introduced through said inlet ports.

8. A solids flow collector according to claim 7, wherein said flange is annular and depends from said top wall.

9. A solids flow collector according to claim 7, wherein said inlet ports are disposed at the same level and are spaced circumferentially relative to and equidistantly from the vertical centerline of the housing member.

10. A solids flow collector according to claim 7, wherein the combined cross-sectional areas of the inlet ports are greater than the cross-sectional area of the outlet port.

11. A solids flow collector according to claim 7, wherein said flow restrictor is provided with a plurality of outwardly projecting fins.

12. A solids flow collector according to claim 11, wherein said fins are peripherally spaced providing a plurality of passage means for guiding solids entering into said housing member substantially toward said outlet port.

13. A solids flow collector according to claim 7, wherein said flow restrictor is adjustable along the vertical centerline of the housing member and said housing member includes a lower, inverted frustoconically configured section cooperable with said flow restrictor to valve the flow of material flowing through the annular interspace between said flow restrictor and said inverted frustoconically configured section of the housing member.

14. A solids flow collector suitable for combining a plurality of streams of particulate solids withdrawn from an elevated mass of solids comprising a housing member having a plurality of inlet ports communicable with passage means for said streams of particulate solids and an outlet port, a flow restrictor disposed in said housing member between said inlet ports and said outlet port, said flow restrictor having a configuration suitable for intercepting solids introduced through said inlet ports into said housing member, said flow restrictor having a wall cooperable with a wall of said housing member disposed between said inlet ports for preventing cross flow of particulate solids between said inlet ports and said flow restrictor having a plurality of outwardly projecting fins.

15. A solids flow collector according to claim 14, wherein said fins are peripherally spaced providing a plurality of passage means for guiding solids entering into said housing member substantially toward said outlet port.

16. A solids flow collector according to claim 14, wherein said housing member includes a top wall, said inlet ports are disposed in said top wall, said flow restrictor is provided with a frustoconically configured wall for intercepting solids introduced through said inlet ports, said cooperable walls include said top wall of said housing member and a top wall of said flow restrictor movable relative to said top wall of said housing member, and said plurality of peripherally spaced fins being disposed on the frustoconically configured wall of said flow restrictor providing a plurality of passage means for guiding solids entering into said housing member substantially towards said outlet port.

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U.S. Cl. X.R.

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